KULLUK AIR PERMIT DISCUSSION

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Introduction.

As you requested, this memorandum provides Shell Offshore Inc. (Shell) with a summary of supplemental information for submission to EPA Region 10 in response to some of the comments EPA received from NAEC and NSB concerning EPA's proposed Kulluk permit. I am providing this information based on my knowledge regarding Shell's planned operations in the Beaufort and my knowledge and experience with respect to air quality matters.[1]

Appropriate Emission Factors.

Commenters have suggested that "Stack testing data is available on the Kulluk drill ship and icebreakers and should be used in the revised permit" NSB p. 14. Commenters also objected to the use of assumed emissions factors, including EPA's AP-42 factors, for sources on the Kulluk and its support fleet for purposes of predicting NO_x emissions. These NO_x emission factors are used for both limiting emissions to 245 tons at any drill site and for modeling impacts from exploration drilling to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS). Shell conducted preliminary stack testing of a number of sources on the Kulluk and its support fleet in Summer 2007, but did not complete the testing or validate the results because the EAB remanded the Kulluk (and Frontier Discoverer) permit to Region 10, the results of which could change the permit and stack testing requirements. Thus, it is not accurate to say that stack test data is available.

Under Section 9.2 of the revised Kulluk permit, stack testing must be done within 24 days of commencing operations at the first Drill Site. Within 15 days of completing the testing, Shell must submit a new emission factor for each source group. These new emissions factors replace the assumed Source Group-specific emissions factors in section 9.1, Tables 3 and

[1] I hold a B.S. in Engineering, Brown University and an M.S. in Geofluid Dynamics, University of Chicago. I am a Professional Engineer registered in Colorado. For over 30 years I have provided air quality consulting and project management services to government and industry. I am also a Certified Consulting Meteorologist (American Meteorological Society).

4. Once established, these updated factors will be plugged into the formulas in sections 8.5 and 8.6 for calculating NO_x emissions and keeping the running total under 245 tons per year. Thus, stack testing will ensure that the owner-requested limits on emissions are met.

While the NAAQS compliance modeling that we performed used estimated emissions factors based on manufacturers' specifications or AP-42 factors, these estimates are often conservative. The modeling demonstration is provided in a technical report to EPA that is in the record, "Kulluk Beaufort Sea Exploratory Drilling Program – Modified Impacts Analysis Report – Approval to Construct No. R10OCS-AK-07-01." The report discusses the nature of the analysis, which is a screening modeling and such an exercise is designed to show that the impacts will be below a particular level. It does not show what those impacts are expected to be. At EPA Region 10's direction, the screening modeling was performed with the following assumptions, designed to provide a maximum impact that would be greater than the actual impact of operations by the Kulluk and its associated fleet:

1. Emission factors are estimated using manufacturer's data when available and generic emission factors (EPA's AP-42 manual) otherwise. This is a normal and commonly accepted permitting practice. These factors are used consistently throughout the permitting exercises to define actual and potentials to emit (PTE) emissions.

2. Both long-term and short-term impacts are defined with all source units emitting at capacity rate continuously. This is an extreme because none of the source units will operate at capacity even over a single day. The nature of a drilling process is that the source units are designed to handle short-term surges but to normally operate at much lower rates.

3. The hypothetical public presence on the open ocean is assumed to extend to the hull of the drill vessel, such that NAAQS must be met at that location in close proximity to the emitting sources on the Kulluk. This is extremely conservative because the anchor pattern extends out 650 meters or more in all directions from the drill vessel, and it is both a safety and equipment hazard for the public to come closer. EPA recognizes safety and equipment protection zones in which the public is prohibited. Because of obstructions to the wind, located on the deck of the Kulluk, impacts are highest adjacent to the vessel and decrease markedly with distance from the hull to 650 meters (and beyond).

4. Under the model, the configuration of source units (the locations of source units with respect to each other) is the worst (causing the highest impact) allowed by the permit. This is highly conservative because the probability of the winds and sources (two independent variables) being in the worst combination is extremely small. Furthermore, this combination assumes that the Jim Kilabuk (supply vessel) and the OSR fleet are

simultaneously upwind of and close to the drill vessel, which in practice is operationally inadvisable and would not occur.

5. The impacts are determined by the worst (highest impact) expected hour of meteorology in the year and the daily and annual impacts are increased by at least a factor of 1.25 to account for uncertainty in dispersion character of the Beaufort Sea region.

The modeled long-term NO_x impact screening value (plus background) is 87 $\mu g/m^3$ and is compared to the NAAQS of 100 $\mu g/m^3$. Subtracting baseline of 3 $\mu g/m^3$ from both these values, the screening maximum impact is 87% of the standard. It would take an overall emission increase of 15.5 percent (97/84) in the NO_x emissions to reach the standard. Since this maximum impact comprises impacts from many source units, for the maximum impact to be over the predicted impact by this amount, there would need to be a uniform bias in the manufacturers' and generic emission factors of over 15.5 percent. While it may be reasonable to expect the emission factor for a single emission unit possibly to be in error by this much, the probability of the emission factors for many emission units being biased uniformly high by this amount is negligible. Thus, in my professional opinion, the screening modeling that is in the record, built as it is on these multiple conservative assumptions, demonstrates that the drill vessel and associated fleet impacts will be in compliance with the NAAQS.

Hydrocarbon Releases from Drilling.

Shell also asked me to comment on NSB's contention that the Kulluk permit must cover emissions of natural gases that might migrate from the subsurface during drilling and be vented to the atmosphere. (As stated in the application, Shell does not plan to flare any gas.) Gaseous hydrocarbons under pressure may be dissolved in the drilling mud that is piped to the surface during the drilling process. These gaseous hydrocarbons may be released when the drilling mud is vented to atmospheric pressure. The majority of any potential gaseous hydrocarbons are methane and ethane, both of which are excluded from regulation as volatile organic compounds and are otherwise not subject to emissions limitations. *See* 18 AAC 50.990(121) and 40 CFR 51.100(s)(1). Any potential release of these gaseous hydrocarbons would be very small, intermittent, fugitive, and unquantifiable and, as such, would not need to be permitted under 18 AAC 50.502 (minor permits for air quality protection).

Consistency in permit compliance conditions related to the one-year period.

It has come to my attention that there are some slight inconsistencies with regard to the one-year period over which certain compliance conditions are determined in the current Kulluk permit. I suggest that Shell ask EPA to make these consistent in the direction of strengthening the protection of the NAAQS. In those compliance conditions referring to

"calendar year", we ask that EPA modify them to refer to "rolling 52-week period" (which contains the calendar year as a subset) except for report submissions (Conditions 8 and 13) and the calculation of fees (Condition 6). The requested modifications should take place in Conditions 2.2, 15.1, 15.2, and 16.1 (b).